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Comparison of electrochemical advanced oxidation processes for removal of ciprofloxacin from aqueous solutions

Hamidreza Pourzamani[a], Nezamaddin Mengelizadeh[b,*], Hamed Mohammadi[b], Noureddin Niknam[c], Bahador Neamati[d], Rohollah Rahimi[d]

[a]*Environment Research Center, Research Institute for Primordial Prevention of Non-communicable disease, Isfahan University of Medical Sciences, Isfahan, Iran, and Department of Environmental Health Engineering, School of Health, Isfahan University of Medical Sciences, Isfahan, Iran, email: pourzamani@hlth.mui.ac.ir (H. Pourzamani)*
[b]*Environment Research Committee, Isfahan University of Medical Sciences, Isfahan, Iran, and Student Research Committee and Department of Environmental Health Engineering, School of Health, Isfahan University of Medical Sciences, Isfahan, Iran, Tel. 09392312472, email: nezam_m2008@yahoo.com (N. Mengelizadeh), hamed.mohamadi36@gmail.com (H. Mohammadi)*
[c]*School of Management and Medical Information, Iran University of Medical Sciences, Tehran, Iran, email: noureddin.niknam@yahoo.com (N. Niknam)*
[d]*Student Research Committee, Shahrekord University of Medical Sciences, Shahrekord, Iran, email: neamatibahador@yahoo.com (B. Neamati), rohollahrahimi2012@yahoo.com (R. Rahimi)*

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ABSTRACT

The aim of this study was to compare the efficiency of two dimensional electrochemical (2DE), electro-Fenton (EF), three dimensional electrochemical (3DE) and three dimensional electro-Fenton (3DEF) processes in removal ciprofloxacin (CIP) from aqueous solutions. The central composite design (CCD) with response surface methodology (RSM) was used to study the effect of experimental parameters on the removal efficiency of CIP by various electrochemical processes. The results showed that obtained quadratic model had a high R-squared coefficient based on the analysis of variance (ANOVA). The optimum condition for the removal of CIP by the studied processes was pH of 3, current of 0.45 A, and electrolysis time of 60 min. The results of the comparison between the processes showed that the removal efficiency of CIP after 60 min of electrolysis time is reduced as follows: 3DEF>3DE>EF>2DE. The removal efficiency enhancement was attributed to much more hydroxyl radicals generated in the three dimensional (3D) processes because single-walled carbon nanotubes (SWCNTs) could activate molecular oxygen to produce more H_2O_2. These results showed that 3D systems, especially 3DEF, could be considered as an appropriate method for the treatment of persistent pollutants such as antibiotics due to good electro-catalytic activity, high efficiency, no secondary pollution.

Keywords: EAOPs; Ciprofloxacin removal; Single-walled carbon nanotubes; Response surface methodology

*Corresponding author.